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ARTICLE COATED WITH FIBROUS BOEHMITE

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This invention relates to base materials having negatively charged solid surfaces which have been coated with and bonded to fibrous alumina monohydrate and to methods of coating those surfaces. This invention further relates to those materials with coated surfaces having fibrous alumina monohydrate as an anchoring agent whereby said materials exhibit improved receptivity for subsequently applied layers of topcoat materials. Still further, this invention includes composite articles having a plurality of layers, at least two of which are secured to one another by fibrous alumina monohydrate as bonding and anchoring agents for negatively charged surfaces.

The present invention is thus broadly directed at a solid base material having at least one negatively charged surface to which a small but effective amount of fibrous alumina monohydrate, preferably in the form of a colloidal suspension or sol, has been applied and effectively bonded. The sol may be an aqueous sol containing $\frac{1}{100}$–25% by weight of fibrous alumina monohydrate. The solid base materials so treated display excellent anchoring for layers of topcoat materials subsequently applied and need only carry slightly more than a trace of the alumina in order to be so benefited in some instances.

Referring to the drawings:

FIGURE 1 is a perspective view of a base material, with its upper surface coated with fibrous alumina monohydrate having the boehmite crystal lattice. Various topcoatings are applied at the areas indicated at A, B and C.

FIGURE 1A is an enlarged view of the alumina-coated surface at A of FIGURE 1 with a copolymer, polyvinyl methyl ether-maleic anhydride, as a topcoating, anchored to the surface.

FIGURE 1B is an enlarged view of the alumina-coated surface at B of FIGURE 1 with a negative colloid, colloidal silica, as the topcoating.

FIGURE 1C is an enlarged view of the alumina-coated surface at C in FIGURE 1 showing a polymerizable monomer, acrylic acid, bonded to the alumina. The topcoating of acrylic acid is shown as attached to the alumina through a typical ester linkage involving the loss of water.

FIGURE 2 shows schematically in section a glass base material which has at its surface an effective amount of fibrous alumina monohydrate, as an anchoring agent, an intermediate layer of perfluorooctanoic acid and a topcoating of "Teflon" which has been sintered to form a continuous sheet.

FIGURE 3 shows schematically in section a glass base material having an effective amount of fibrous alumina monohydrate as an anchoring agent and an intermediate layer of methacrylic acid with a topcoat of a polyester laminating resin.

FIGURE 4 shows schematically in section a cellophane base material which has as its surface an effective amount of fibrous alumina monohydrate to anchor an intermediate layer of urea-formaldehyde resin with a topcoat of polyethylene.

FIGURE 5 illustrates schematically in section a paper base material having as an anchoring agent fibrous alumina monohydrate which effectively retains a layer of subsequently applied perfluorooctanoic acid.

This application is a continuation-in-part of my U.S. patent applications Serial No. 357,623, filed May 26,

1953, now abandoned; Serial No. 519,559, filed July 1, 1955, now abandoned; Serial No. 594,265, filed June 27, 1956, now abandoned; Serial No. 730,025, filed April 21, 1958, now abandoned; and Serial No. 783,602, filed December 29, 1958, and issued December 1, 1959, as U.S. Patent 2,915,475. This application is also a continuation-in-part of applications Serial No. 792,447, filed February 10, 1959, now abandoned; Serial No. 730,023, filed April 21, 1958, now abandoned; and Serial No. 809,883, filed April 29, 1959, now abandoned.

Details of the invention will now be given:

Base materials

In general, a solid base material to be coated with fibrous boehmite need have no special attributes. Physical characteristics such as density, porosity, surface-area, strength and the like, and chemical characteristics such as composition, natural or synthetic origin, and the like, are, in general, not significant.

It is preferred, however, that the surface to be coated of such solid base material be negatively charged with respect to the charge of the fibrous boehmite. This is because the fibrous boehmite will attach itself to negatively charged surfaces through bonding. Fibrous boehmite, which is positively charged, has an affinity for such negatively charged surfaces leading to electrostatic bonding between base material and fibrous boehmite. Such bonding may be greatly supplemented by actual electron sharing which involves both coordinate and covalent uniting.

Thus, when negatively charged surfaces are coated with sols or dispersions of positively charged fibrous boehmite according to the present invention, several distinct types of molecular forces may be involved in bonding the fibrils or aggregates to those surfaces. Those bonds due to opposite polar charges are concerned with Van der Waals' forces commonly having an energy of the order of 2,000–10,000 calories per mole. Chemical linkages through covalent bonds have an energy value of from 10,000–200,000 calories per mole. Coordination bonding approximates covalent bonding in strength. When more than a monomolecular layer of fibrous boehmite is coated on a surface, the hydroxyl groups present at the surfaces of the fibrils and other structural characteristics assist to permit the formation of multi-layered fibrils strongly bonded to the solid base material.

Generally, those base materials having negatively charged surfaces are characterized by having substantial proportions, that is, above 5%, of an element or elements selected from the group of oxygen, nitrogen, halogen and sulfur. These elements frequently are present in highly polar groups such as —OH, $—NH_2$, —COC, —NH—

$$-\overset{|}{C}=O$$

—COOH, $—SO_3H$, and others. Such base materials which may be satisfactorily coated with fibrous alumina monohydrate include most of the principal industrially important organic and inorganic materials, and a representative list thereof is included below.

Those materials included herein which are not negatively charged or do not contain substantial proportions of highly charged polar groups containing oxygen, nitrogen, sulfur, halogens or the like can nevertheless be made highly receptive to fibrous alumina monohydrate and to that end can either be modified by the chemical incorporation of compounds which themselves have substantial proportions of such elements, or may be mixed or otherwise associated with other materials which have negatively charged surfaces. Thus, polymers and copolymers during manufacturing processes or aging periods may partially oxidize, or they may assimilate on or near